

**AGRONOMY 485/585\***  
**SOIL MICROBIAL ECOLOGY**



Outline and Assigned Reading  
Fall 2008

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If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me soon. Please request that Disability Resources staff send a SAAR form verifying your disability and specifying the accommodation you will need.

**A COURSE INTRODUCTION**

A1 Text: Principles and Applications of Soil Microbiology, Syliva et. al., 2005, 2<sup>nd</sup> ed.  
Required readings for the course are in **bold** and enhanced readings (no test questions asked but likely will aid in better understanding of the topic) are in *italics*.  
Some enhanced reading are written at a lower level than your text, others at a more in-depth level.

A2 References ([on reserve](#) in library)  
Alexander--Biodegradation and Bioremediation, 1999 (**A**)  
Coleman and Crossley--Fundamentals of Soil Ecology, 2004 (**CC**)  
Coyne--Soil Microbiology, 1999 (**C**)  
Paul--Soil Microbiology, Ecology, and Biochemistry, 2007 (**P**)  
Richards--The Microbiology of Terrestrial Ecosystems, 1987 (**R**)  
Tate--Soil Microbiology, 2000 (**T**)

A3 Grading and exams

	<b>Points</b>
<b>Lecture</b>	
1-hr exam	
October 7	100
November 6	100
Final (week of December 15)	150
<b>Laboratory</b>	
Three quizzes @ 20 pts each	60
Final	40
Laboratory Notebook	50
<b>TOTAL</b>	<b>500</b>

\*Students taking the course as Agron 585 have additional expectations.

- A4 This course will provide you with an understanding of soil organisms, their types, numbers, activities, and will discuss soil life in relation to human existence, land use, and the environment. **“To appreciate them, one must understand them.”** Observations, methods of isolation, enumeration, and means of studying transformations will be emphasized in the laboratory.
- A5 Overview of importance--Why study soil biology?
- A6 Historical accounts and the "Golden Age" of soil microbiology, **Text: 3-25; C: 3-12; P: 3-24.**
- B SOIL AS A BIOLOGICAL ENVIRONMENT, Text: 26-53.** If this is your first course in soil science, you also may wish to read *CC: 1-21* (good overview) and/or *C: 139-179; T: 1-29*. Confused with terms or concepts, ask to borrow an introductory soil science textbook from me.
- B1 Soil composition--minerals, organic fractions, charge, size relationships
- B2 Important variables--moisture tensions, atmospheric compositions, temperature, humus, pH
- B3 Brief soil biota size/number overview
- C METABOLIC REQUIREMENTS AND GENETICS, Text: 54-98; C: 14-26; T: 37-75, 133-154.**
- C1 Water
- C2 The Five Essentials--energy source (electron donor), electron acceptor, carbon source, minerals, and growth factors
- C3 Growth curves
- C4 Genetics and gene exchange
- D BACTERIA, ARCHAEA, AND ACTINOMYCETES, Text: 101-139; C: 100-123.**
- D1 What are soil bacteria and archaea?
- D2 General taxonomy, morphology, and metabolic diversity
- D3 Geochemical groupings
- D4 Actinomycetes in soil as a distinguishable group
- D5 Importance of actinomycetes
- E FUNGI, Text: 141-161; C: 86-99.**
- E1 Differences among bacteria, actinomycetes, and fungi
- E2 Taxonomy, selective media, and methods of investigation
- E3 Bacterial spore and fungal conidia comparison
- E4 Soil structure and fungal involvement
- E5 Fairy rings
- F CYANOBACTERIA AND ALGAE, Text: 162-180; C: 77-85.**
- F1 Growth requirements and significance in soil
- F2 Kinds of soil algae
- F3 Lichens and soil formation
- G VIRUSES, Text: 201-221; C: 124-136.**
- G1 What are soil viruses?
- G2 Determining presence in soil
- G3 Activity and scope

- H PROTOZOA, Text: 181-200; C: 67-76; CC: 79-89; P: 163-169.**
- H1 Most-probable-number (MPN) technique
  - H2 How to identify soil protozoa
  - H3 Motility and classification
  - H4 Cysts formation and separation from vegetative cells
  - H5 Environmental influences and significance
- I NONPROTOZOA FAUNA, CC: 89-128, 169-181; C: 43-66; P: 169-186; R: 46-61.**
- I1 Neglected group
  - I2 Nematodes
  - I3 Earthworms
  - I4 Others
- J ECOLOGY AND METHODS FOR STUDY, Text: 222-241; T: 37-94; P: 53-83, 85-118.**
- J1 Real world interactions
  - J2 Direct methods
  - J3 Cultural methods and Biolog data
  - J4 Molecular methods
  - J5 Product transformations
- K DECOMPOSITION OF ORGANICS, Text: 285-297; T: 284-313.**
- K1 Carbon cycle
  - K2 Types of organics
  - K3 Assimilation
  - K4 Mineralization and immobilization
  - K5 The art of composting, **Text: 587-606**
- L COMMON ORGANICS IN PLANTS AND WASTES, Text: 298-318; Handouts; C: 291-305; P: 312-325.**
- L1 Cellulose
  - L2 Starch
  - L3 Hemicellulose
  - L4 Lignin
  - L5 Other polysaccharides, chitin, pectin, protein, and lipids
- M ORGANIC MATTER AND SOIL QUALITY, Text: 318-332.**
- M1 Organic matter components
  - M2 Priming effect
  - M3 Management for high soil organic matter levels
- N BIOREMEDIATION AND RECALCITRANT ORGANICS, Text: 510-535; A: 393-406; T: 464-494.**
- N1 Human-produced organics (xenobiotics)
  - N2 Conditions for biological growth vs. cometabolism
  - N3 Microbial degradation pathways
  - N4 Tough bonds to break

- O**     **BIOREMEDIATION TECHNOLOGIES IN SOIL, Text: 536-561; A: 325-349.**
- O1     Criteria for bioremediation
- O2     Land farming
- O3     Phytoremediation
- O4     Bioventing
- P**     **THE RHIZOSPHERE AND ORGANISMAL DISTRIBUTION WITHIN THE SOIL, Text: 242-262; T: 218-235.**
- P1     Exudates
- P2     R/S ratios
- P3     Beneficial and harmful effects
- P4     Pathogenic relationships
- Q**     **MYCORRHIZAE, Text: 263-282; P: 259-267; T: 235-244.**
- Q1     Ectomycorrhiza
- Q2     Endomycorrhiza
- Q3     Environmental importance
- R**     **THE NITROGEN CYCLE, Text: 333-278; P: 341-364; T: 314-346.**
- R1     Historical--Schloesing and Muntz, Warrington, and Winogradsky
- R2     Nitrifying bacteria
- R3     Environmental influences
- R4     Nitrification inhibitors
- R5     Denitrification
- R6     Environmental factors and significance
- S**     **NITROGEN FIXATION, Text: 373-432; P: 364-387; T: 347-403.**
- S1     Nonsymbiotic
- S2     Symbiotic
- S3     The symbioses
- S4     Biochemistry of the fixation process
- T**     **NONCONVENTIONAL SOIL ADDITIVES, A: 299-323.**
- T1     Inoculants
- T2     Wonder products
- T3     Evaluation
- U**     **MICROBIAL PROCESSES AND THE ENVIRONMENT, (no required reading), Text: 433-488; C: 183-194, 208-227.**
- U1     Oxidation and reduction of sulfur (Why is the Black Sea black?)
- U2     Oxidation and reduction of iron
- U3     Heavy metal impacts in the environment and affects on organisms



***Please let me know at anytime throughout the course how I can be of help.***